A Prospect of Petroleum and Natural Gas Supply and Demand in China and in the World by 2010 and by 2020

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1 A Prospect of Petroleum Supply and Demand in the World

1.1 Demand

Petroleum, as a kind of important strategic materials and high-quality energy resources, always plays a decisive role in the economic development of all countries in the world. In the past twenty years, petroleum increased by an average of about 1% a year and occupied a leading position in the energy consumption structure in the world. Although natural gas develops very quickly in recent years, the leading position of petroleum doesn't be changed in a rather long period in the future.

According to the estimate by an international energy resources organization, 40% of primary energy resources demand will be provided by petroleum in the world by 2010. In the period from 1995 to 2010, the worldwide demand for petroleum will increase by an average of 2.1%~2.4%. It is predicted that the worldwide demand for petroleum will reach 4.4~4.6 billion tons by 2010, including 0.98~1 billion tons in Asian Pacific area. In this period the petroleum demand increase amount in Asian Pacific area will account for about 45% of the total increment in the world. According to our analysis, in the period from 2011 to 2020, the increase rate of petroleum demand in the world will decrease with reduction of the world economic increase rate. Under this condition, the worldwide demand for petroleum will increase by an average of 0.87%~1% a year. It is estimated that the worldwide demand for petroleum will reach 4.8~5.1 billion tons by 2020, including 1.5~1.6 billion tons in Asian Pacific area.

Table 1-1 Demand for petroleum in the world and Asian Pacific area **unit: million tons**

	1995	2000	2010	2020
World	3235	3600~3700	4400~4600	4800~5100
Asian Pacific area	848	980~1000	1370~1425	1500~1600

Note: The Asian Pacific area represents the Asian and Pacific countries.

1.2 Supply

The world is abundant in petroleum resources. By January 1, 1997 the residual recoverable reserves of petroleum are 139 billion tons in the world. According to the present reserve-exploitation ratio, the exploitation period can last 42 years or so. In addition, the worldwide petroleum reserves increase unceasingly. Only in the past twenty years, the residual verified

reserves increased by 50%. However, the petroleum resources are not distributed uniformly. 66 % of the worldwide residual verified reserves are concentrated in Middle East area and the others are successively distributed in Northern America, Middle and Southern America, the former USSR, Africa and Asian Pacific area. In 1997, the residual verified reserves in the countries of OPEC(Organization of Petroleum Exporting Countries) accounted for 77.4 % of the total reserves in the world, while those in other countries only accounted for 22.6%.

In 1997, 3.247 billion tons of petroleum were produced altogether globally, 41.5 % of which were from the countries of OPEC. According to the analysis by the international energy resources organization, from the middle-run petroleum supply point of view, the resources in the countries not attached to OPEC can satisfy most of the worldwide petroleum demand increase. However, from the long-run point of view, the petroleum supply still depends on the countries of OPEC. In the period from 2000 to 2010, the world petroleum yield will increase by an average of 1.96%~2.1% a year. It is estimated that the world petroleum yield will reach 4.4~4.6 billion tons by 2010, 50%~53% of which will be from the countries of OPEC. According to our prediction, the world petroleum yield will reach 4.8~5.1 billion tons by 2020. From the equilibrium of the petroleum supply and demand point of view, by 2010 the dependency degree of OECD on the petroleum import will rise to 60% or so from 50% in 1995, while the dependency degree of the developing countries in Asia on the petroleum import will reach 65%. Most of the petroleum to be imported will be supplied by the countries in the Middle East.

2 A Prospect of the Natural Gas Supply and Demand in the World

2.1 Demand

With more concern with the environmental problem in the world, continual expansion of natural gas pipe network, unceasing progress of LNG technology and more and more worry about petroleum, the efficient and clean natural gas has increasingly attracted people's attention. During the 26 years from 1970 to 1996, the natural gas consumption increased by 2.2 times, by an average of 3.1% a year; the proportion of natural gas in the primary energy consumption sharply increased to 20.1 % in 1970 from 10.2 % in 1950 and continually increased to 23.5% in 1996. It is considered commonly that the 21st century will be an era of natural gas.

According to the estimate by the world energy resources commission, the worldwide natural gas demand will increase by an average of 2.76% a year in the period from 1995 to 2010, among which the natural gas demand in Asian Pacific area will increase most quickly, by an average of 5.28% a year. It is estimated that the worldwide natural gas demand will reach 3.19 thousand billion m^3 by 2010, including 474 billion m^3 in Asian Pacific area.

From 2010 to 2020 the natural gas demand will increase by an average of 1.36 % a year in the world, while will increase by an average of 2.35% a year in Asian Pacific area. It is estimated that the worldwide natural gas demand will reach 3.65 thousand billion m^3 by 2020, including 598 billion m^3 in Asian Pacific area.

Table 2-1 Natural gas demand in the world and Asian Pacific area **unit: GM^3**

	1995	2010	2020
World	2120	3190	3650
Asian Pacific area	219	474	598

2.2 Supply

By 1996 the residual verified recoverable reserves were 141.33×10^{12} m^3 in the world, and under the present reserve-exploitation ratio of 62.2 they can completely meet the natural gas supply around 2020. During the 26 years from 1970 to 1996, the worldwide residual recoverable reserves of natural gas increased by an average of 4.88% a year and the natural gas yield increased by an average of 3.1% a year, which greatly exceeded the increase rate of other energy resources including petroleum. In 1990s, the natural gas trade develops more quickly. From 1990 to 1996, in the world the natural gas trade volume increased by 38.4%, by an average of 5.6% a year; however, in 1980s in the same period the natural gas trade volume only increased by 14%, by an average of 2.2% a year.

For the natural gas supply prospect predicted by the world energy resources commission, see Table 2-2. Under the driving of investment and market, in the world the natural gas yield can reach 3.64 thousand billion m^3 by 2010 and 3.988 thousand billion m^3 by 2020. Because the countries producing natural gas in the world have taken the development and utilization of natural gas as an important item of their national energy resources policies, they have enhanced the exploring and development of natural gas, natural gas transmission pipes construction and input of liquefied natural gas project, and are actively opening up the international natural gas market. Therefore, the worldwide natural gas supply will be guaranteed.

Table 2-2 A prospect of the worldwide natural gas supply **unit: GM^3**

	1995(actual)	2010	2020
World	2164	3640	3988
Asian Pacific area	202	406	493

Due to rapid increase of the natural gas demand in the Asian Pacific area, the natural gas insufficiency will gradually enlarge in this area, reaching 68 billion m^3 and 105 billion m^3 by 2010 and by 2020 respectively.

3 A Prospect of Petroleum Supply and Demand in China

3.1 Present situation of petroleum consumption in china

With rapid development of the national economy and improvement of people's living standard, the petroleum demand is increasing quickly. Since 1990s, the petroleum consumption has increased to 176.56 million tons in 1996 from 114.86 million tons in 1990. During the six years, the petroleum consumption increased by an average of 7.4 % a year. The petroleum demand increase amount in China accounted for one third of the total increment in the world. From 1970s to early 1980s, due to the policy of limiting the petroleum consumption and replacing petroleum with coal, the petroleum consumption increase was slightly lower than the crude oil yield increase in China. Since late 1980s, the petroleum consumption increases with GDP to a greater degree, so the petroleum demand exceeds the production increase, thus leading to the increase of the imported petroleum. In 1996 the petroleum consumption increased by 53.7% in comparison with that in 1990, among which the gasoline consumption amounted to 31.28 million tons and increased by 67.5%, the kerosene consumption 5.56 million tons and increased by 58.4%, the diesel consumption 44.09 million tons and increased by 63.8%, and liquefied petroleum gas 9.23 million tons and increased by 263%. In the petroleum consumption by branch departments, the industry is a main consumer of petroleum. In 1996, the petroleum

consumption in the industry department reached 80.22 million tons, which accounted for 45.4% of the total petroleum consumption. Next, the petroleum consumption in communications and transportation, agriculture, residents and service trades respectively accounted for 16%, 7%, 5% and 2%.

3.2 A prospect of petroleum demand

3.2.1 Reference for the prospect

- Development trend of the national economy

In order to basically realize the modernization in the next middle century, in the *Ninth Five-year Plan for the National Economy and Social Development and Programme of Prospects Goal by 2010*, the Chinese government set forth the struggle goal for the ninth five-year plan, i.e. by 2000 the population will be controlled within 1.3 billion and per-capita GDP will quadruplicate that in 1980, and the main goal by 2010 that GDP will double that in 2000 and the population will be controlled within 1.4 billion. It is estimated that GDP will increase by an average of 6% a year from 2011 to 2020 and the population will reach 1.5 billion by 2020.

Table 3-1 Conditions of economic development, population increase and urbanization rate in different periods in China

	1990	1995	2000	2010	2020
GDP(thousand billion yuan according to the annual price in 1995)	3.27	5.76	8.50	17.0	30
Annual average increase rate of GDP	12.0%		8%	7.2%	6%
Population(hundred million)	11.43	12.11	13	14	15
Population increase rate	11.6‰		14.3‰	7.4‰	7.4‰
Urbanization rate	26%	29%	35%	45%	50%

- Industrial structure change trend

Since 1980s great changes have taken place in the Chinese industrial structure, but the industrial structure is still not rational, particularly the third industry has a lower share in GDP. According to the industrial policy made by the state, in the future the Chinese increase rate in agriculture will be much lower than in industry and the third industry, and the agricultural proportion will take on a decrease trend. It is estimated that in 2000 the proportion of the third industry will exceed that of industry and building industry and the proportion of the second industry will decrease. In 2010, the third industry will occupy a leading position in GDP, which coincides with the change trend of the industrial structure in all countries in the world. Therefore, the

change trend of the national economic structure will directly drive the sharp increase in petroleum and natural gas consumption demand.

Table 3-2 Change conditions of the industrial structure

	1990	1995	2000	2010	2020
GDP (according to the annual price in 1990)	1854.8	3230	4800	9600	17200
Composition (%) of the industry: The first industry	27.1	20.6	17.0	12.0	10.0
The second industry	41.6	48.4	45.0	43.0	39.0
The third industry	31.3	31.1	38.0	45.0	51.0

- Communications and transportation development trend

The communications and transportation, as a state basic industry, has developed quickly in recent years. The national civil vehicles have increased to 10.4 million in 1995 from 5.5136 million in 1990, by an average of 13.5% a year, which is much higher than the average increase rate a year of 1.47% in the crude oil yield in the same period and still increasing sharply. Because the activity level in the communications and transportation department is closely related to the petroleum consumption, the rapid development of the communications and transportation will drive the swift and violent increase in the petroleum demand

Table 3-3 Development trend of Chinese communications and transportation

	1994	2000	2010	2020
Goods circulating amount(hundred million ton kilometer)	33261	46345~55773	79089~90848	119686~147848
Number of retention vehicles(ten thousand)	968.9	1930~2180	3800~4600	7500~8500

- Petrochemical industry

In the recent ten years, the Chinese petrochemical industry has made progress to a certain extent, with the ethylene yield increasing rapidly, which, however, can't still meet the need of rapid development of the national economy and falls farther behind the development level of the world petrochemical industry. According to the analysis in the related materials, the per-capita ethylene yield of a country has an approximate linear relationship with its per-capita GDP. Therefore, with the economic growth, the Chinese ethylene yield will increase more rapidly, thus resulting in the violent demand increase of the petroleum used to produce ethylene.

- Environmental problem

In recent years China has made some progress in its environmental protection, but the environmental conditions are still not optimized. Till now China has not taken effective measures toward sulphur dioxide, so serious regional "acid rain" and sulphur dioxide pollution in a large area occurred, and in recent years the pollution has taken on a worsening trend. In the Chinese energy production and consumption structure, coal occupies a central position, large

consumption of which is a main emission source of air pollution. In order to realize the sustained development, China must speed up the process of energy resources improvement that coal should be replaced with high-quality petroleum and natural gas. Therefore, from the environmental protection point of view, it is required to increase the petroleum and natural gas demand amount.

3.2.2 Prediction Result analysis

The scheme is established as follows: In the prediction two schemes are adopted, i.e. basic scheme and high scheme. The former means that according to the social and economic development goal determined by the Chinese government, the present petroleum consumption mode and energy utilization structure and existing technical and economic level, the petroleum demand prediction is made. The high scheme means that on a emphasis of increasing the proportion of petroleum in the energy resources structure and more utilizing the high-quality energy resources to improve the environment to a greater extent, the petroleum demand prediction is made.

The prediction results are shown in Table 3-4.

Table 3-4 Chinese demand amount for crude oil and main oil products unit: million tons

		Crude oil	Gasoline	Kerosene	Diesel oil	fuel oil	LPG
1995		147.95	29.09	5.12	40.7	22.63	7.49
1996		159.21	31.82	5.56	44.09	23.21	9.23
2000	**Basic scheme**	190.00	40.00	7.00	60.00	35.00	10.00
	High scheme	210.00	44.00	8.00	66.00	37.00	13.00
2010	**Basic scheme**	270.00	63.00	12.00	95.00	39.00	18.00
	High scheme	310.00	70.00	14.00	110.00	42.00	20.00
2020	**Basic scheme**	370.00	88.00	16.00	140.00	46.00	28.00
	High scheme	420.00	98.00	18.00	155.00	52.00	32.00

In the future the Chinese petroleum demand will have the following characteristics:

- The Chinese crude oil demand amount will reach 190~210 million tons by 2000, 270~310 million tons by 2010 and 370~420 million tons by 2020. From 2000 to 2020, the Chinese crude oil demand amount will increase by an average of 3.4% to 3.5% a year, among which from 2000 to 2010 the Chinese crude oil demand increase rate will be 3.6%~4% and from 2011 to 2020 it will be 3.2%~3.1%.

- Gasoline will still increase at a high speed. During the twenty years from 2000 to 2020 the gasoline demand will increase by an average of 4.0%~4.1% a year. The communications and transportation department is a main consumer of gasoline, and the industrial department takes second place. In the predicted period, the gasoline consumption in the communications and transportation department will account for more than 40% of the total gasoline consumption, and in the industry department it will account for about 25%.

- Due to rapid development of aviation transportation industry the aviation kerosene demand increases swiftly. The aviation kerosene demand will account for 59% of the total kerosene

demand by 2000 and 85% by 2020. However, with rapid development of electric power, in the countryside and outlying districts kerosene lamps will be replaced with electric lamps gradually, so lamp kerosene demand amount will increase slowly.

- Diesel oil is still an oil product which is demanded most largely and increases at a rate only inferior to LPG increase rate. In the whole predicted period diesel oil will increase at a rate of 4.3%~4.4%. In the diesel oil consumption structure, the diesel oil demand in the communications and transportation department will increase most rapidly and have a largest proportion of about 31%, while the proportions of diesel consumption in industry and agriculture will take on a decrease trend in the total consumption, but respectively account for over 20%.

- Because the Chinese government has adopted the policy of reducing oil burning, the fuel oil demand amount will increase slowly. More than 90% of the fuel oil are consumed by the industry department to be mainly used for power generation and industrial boils.

- LPG is an oil product the demand for which increases most quickly. In the whole predicted period, LPG will increase by an average of up to 5.4%~6% a year. The kitchens of town and country residents are main consumers of LPG. In 2000 the LPG amount demanded by town and country residents will account for over 80% of the whole LPG demand amount.

- As the demanded amount of crude oil increases at a fairly high speed, while the population increases at a degraded speed, the average consumption amount of crude oil per person has a fairly big increase, i.e., increasing from 122 kg/person in 1995 to 146~161 kg/person in 2000 and 233~253 kg/person in 2020. However, compared with the world level, the difference, though reduced, is still big.

3.3 Analysis of the petroleum supplying ability in China

China is a country with fairly rich oil and gas resources in the world. According to the second national oil and gas resources evaluation finished in 1993, the total volume of petroleum resources on the 150 deposit basins of the land and the continental shelves (excluding Taiwan province and southern Nanhai Sea area) is 94 billion tons, among them, about 69.4 billion tons are crude oil from land (36.4 billion tons from eastern oil areas, 25.81 billion tons from western oil areas), 24.6 billion tons are from sea. Up to the end of 1996, the total verified petroleum geological reserves in China are 18.1 billion tons, with the verified degree of 19.2%.

At present, after over 20 years' exploration and development, the eastern areas are entering the medium exploration period, but there are still fairly good exploration potentialities. The residual petroleum resource volumes in the eastern areas now are still 23 billion tons. It is predicted by specialists that through exploration on the new areas and new basins outside the eastern oil areas, new petroleum reserves can be discovered successively under efforts, and at the same time, such new techniques as the triple recovery should be positively spread at the old oil areas to increase the recovery ratio and prolong the stable yield period. By 2000, the yield of the eastern areas can be stabilized at the current level (120 million tons). Before 2010, through increasing the

investment on exploration and improving the technological level, it is also possible to stabilize the yield at 120 million tons.

With rich oil and gas resources, the western area is a new strategic replacing area for developing the on-land petroleum industry of China. In recent years, with the enhancement of oil-gas exploration and development at the western area, the yield of crude oil at the western area is increased fast, raising from 17.19 million tons in 1995 to 22.28 million tons in 1997. But at the present, the western area is still at the initial exploration phase. As its complex oil-gas distribution and bad natural environment, quick increase in the yield of crude oil before 2000 is not possible. It is estimated that until the year 2010, the crude oil at the western area can possibly reach 50~55 million tons.

The petroleum geological reserves at the sea are fairly rich in China. But affected by the geological conditions of sea and restricted by the disputes at the peripheral territorial sea, the exploration and development at the sea are fairly slow. In the recent two or three years, great progress has been made on oil-gas exploration at sea, and until 1997, 3 hundred million ton-level reserves oil-gas fields have been discovered at sea. The yield of crude oil at sea is 16.2 million tons in 1997. Some national oil specialists estimate that before 2000, the annul petroleum yield at sea can be maintained at 15 million tons or so, and that in 2010 it can possibly reach 15~20 million tons.

The on-land central area, part of southern area and Qinghai-Xizang area of China, with their residual volume of petroleum resources holding 12% of the total residual resources volumes, have a certain resources potentialities. So long as the evaluation of the areas is strengthened, and the exploration of the new areas is quickened, it is expected that new oil-discovery areas will be opened up.

In accordance with the final exploitation-reserves of petroleum, and the current production status and exploitation level of crude oil in China, it is estimated that the yield of crude oil in 2000 will be 160~165 million tons, that in 2010 will be 175~200 million tons, and that in 2020 will be 165~180 million tons.

Table 3-5 Supply-Demand difference of petroleum in China Unit: million tons

	2000	2010	2020
Demanded volume	190~210	270~310	370~420
Internal production yield	160~165	175~200	165~180
Supply-demand difference	30~45	95~110	205~240

3.4 Petroleum import sources of China and the countermove

In view of the above-mentioned supply-demand prospect analysis, China's import volume of crude oil in 2000 is up to 30~45 million tons, and 95~110 million tons and 205~240 million tons in 2010 and 2020 respectively. After 2010, China, with the imported petroleum volume arranged only behind America and Japan, will enter the forefront of the world leading powers for crude oil import. At that time, imported crude oil will become important composition of our oil supply.

Considering the potentiality of crude oil supply at the international market, the development trends of type and trade flow of petroleum, and the geographical positions of the export countries, the Middle East area will be the first selected oil supply area of China. The petroleum export volume of this area is currently about 50% of the world's total petroleum export volume, and China has imported 48% of its total petroleum import volume from the Middle East in 1997. It is estimated by specialists that during 2000~2010, more than 80% of China's imported crude oil will be from the Middle East. The south America, Africa, former Soviet and Asia-Pacific area will be the next.

To ensure the safety of oil supply in China, besides that the petroleum import directions and modes are determined in accordance with the multivariated, multi-side and multi-way principles, necessary resources diplomacy should be carried out from now on, thus to make our diplomacy and foreign trade policies as well as armament constructions serve the petroleum import; On the current basis of the international management of petroleum industries, we should increase petroleum exploration and development abroad, take part in the petroleum resources development at areas of Russia, central Asia, Middle East and Latin America, etc. through various modes, such as purchasing stock equity, participating stock and sole propriety exploration and development and so on, thus to compensate the inadequate petroleum supply of our country; Under the great trends of global economic integration, we should strengthen the economic cooperation with the northeast Asia, establish the energy supply system of northeast Asia, and develop cooperatively the oil-gas resources at disputed areas. Moreover, we should quicken the development of natural gas, water power, nuclear power and recycling energies (such as wind energy, solar energy).

4 Prospect of natural gas supply-demand in China

4.1 Demand

The natural gas is a kind of clean energy and a high-quality raw material in chemical industry. With the insufficient petroleum supply and gradually strengthened environmental protection in China in recent years, the natural gas usage problem has been paid broad attention to by the government, the natural gas industries and the vast energy using departments. At the first several years in the next century, the natural gas market will be developed within the whole country, and will be developed quickly after 2005.

The increase of demand for natural gas will be faster than that of coal and petroleum in China. It is estimated that the proportion of natural gas in the total energy demands will be about 6% in

2010 and 10% in 2020, and at that time, if estimated according to the basic demand, the demands for natural gas will be up to 90 and 200 billion m^3 respectively. Among them, electricity generating and civil use of natural gas will get great development, up to 2020, there will be 42% of natural gases used for generating electricity, 22% used as combustion gases in cities, 16% used for chemical industries, and 20% used for industries and other users in China.

Table 4-1 Estimation of demands for natural gas Unit: hundred million m^3

	1991 (actual)	1996 (actual)	2010	2020
Total demands	160.7	201.14	900	2000
Electricity generating	6.4	7.45	348	844
Civil use	18.1	19.72	180	440
Chemical industry	54.4	48.06	190	325
Industry and others	81.8	125.9	182	391

4.1.1 Electricity generating

Electricity generating is of the main field in global natural gas usage, and also is the main breakthrough for China to start its natural gas market. As used for generating electricity, the natural gas has less pollution, occupies small land, operates flexibly and the cost is endurable, it is paid attention to at areas with dense population, bad pollution and developed economy, and natural gas will be the main energy source for generating electricity in place of coal. Especially at the coastal area of southeast China and some other big cities, natural gas will become the main energy source for establishing new power plants.

In the dozens of years in the future, the electricity demand in China will increase continuously, and it is estimated that the electric energy will be increased by 1524.95 billion kilowatt-hours in 2010 in comparison to that in 1996, among them, thermal electric energy will increase by 1161.28 billion kilowatt-hours. If at that time, 15% thermal electric energy uses natural gas as energy source, 34.8 billion m^3 of natural gases will be required.

If in 2020, 20% newly increased thermal electric energy use natural gas as energy source, then 84.4 billion m^3 of natural gases will be required.

Table 4-2 Estimation of natural gas demands for generating electricity

	Newly increased electric energy	Among them: newly increased thermal electric energy	Proportion of the gas-electricity	Electric energy of the gas-electricity	Consumption of natural gas
	hundred	hundred	%	hundred	hundred

	million kilowatt-hours	million kilowatt-hours		million kilowatt-hours	million m^3
2010	15249.5	11612.8	15	1741.9	348
2020	30910.4	22833.9	20	4566.8	844

4.1.2 Combustion gas in cities

Using natural gas as combustion gas in cities has an optimistic prospect. It can not only compete with LPG, but also replace coal gas, kerosene and even coal. The population in China is numerous, people's living standard and urbanization rate are increasingly improving, which opens a broad prospect in natural gas usage. Generally, in the combustion gas used in cities, about half of them is for daily lives of families, such as cooking, and the other half is for other users as warming boiler and business.

Currently, about 40% of Chinese families in towns use gases, and it is estimated that until 2010 and 2020, 70% and 85% of Chinese families in towns will use gases respectively. The proportion of the natural gas users among the combustion gas residents now is 10%, and will be greatly increased with the broad use of natural gases in early next century, the estimated value is 30% in the first ten years of the next century, and 40% in 2020.

According to estimation, the population of China at cities and towns in 2010 and 2020 will be 528 million and 666 million respectively, and the total household numbers at cities and towns then will be 150 million and 190 million. In view of these, the natural gas demand of residents will be estimated to reach 9 and 22 billion m^3 respectively.

Considering other users such as warming and business, among the combustion gases, the demands for natural gases in cities can reach 18 billion m^3 in 2010 and 44 billion m^3 in 2020.

Table 4—3 Estimation of Demand of Natural Gas Used for Residential Lives

	Number of households in city and town	Rate of gasification	Number of households using gas	Proportion of natural gas	Number of households using natural gas	Volume of natural gas
	a hundred million		a hundred million		a hundred million	
2010	1.5	70%	1.1	30%	0.3	90
2020	1.9	85%	1.7	40%	0.6	220

4.1.3 Gas for chemical industry

For now, chemical industry is the second largest user in China. Nearly one fourth of natural gas is used as industrial chemical, more than 90% of which is used to produce chemical fertilizer. Since the consumption of natural gas used by chemical enterprises such as chemical fertilizer factory is quite large, natural gas is welcomed with open arms by gas supplying units at the starting stage. Therefore, in recent 10 or 20 years, there will be a considerable progress with chemical industry of natural gas.

As China is a great agricultural country which has lots of people and relatively a little cultivated land, and meanwhile chemical fertilizer plays an important role in increasing food production, it can be predicted that fertilizer requirement in China will keep a very fast ascending impetus. Predicted by the department concerned, the requirement of synthetic ammonia will reach an amount of 40 million tons in 2010, almost 10 million tons more than that in 1997, and the amount will be 45 million tons in 2020.

Table 4—4 Estimation of Demand of Natural Gas Used for Chemical Fertilizer

	1996(practical)	2010	2020
Newly increased synthetic ammonia(ten thousand tons)	3064	4000	4500
Proportion of synthetic ammonia made from natural gas	18%	30%	50%
Yield of synthetic ammonia made from natural gas(ten thousand tons)	551.52	1600	2700
Consumption of natural gas to produce a ton of synthetic ammonia(m^3/ton)	1185	1000	1000
Natural gas consumption(hundred million)	65.36	120	225

In the natural gas chemical industry, hydrogen producing, methanol producing and ethylene producing will be somewhat developed too. According to the estimation, their demands for the natural gas will be 7 billion m^3 in 2010 and 10 billion m^3 in 2020.

In all, the total demand of natural gas in the natural gas chemical industry will be 19 billion m^3 in 2010 and 32.5 billion m^3 in 2020.

4.1.4 Other users such as industrial fuels

There is a good prospect of the natural gas to be used in many fields such as industrial fuels, natural gas cars, etc.

Industrial fuel is by now the largest natural gas consumer in China. However, because the Chinese enterprises have an inferior ability to uphold the price of the natural gas and the consumers are disperse, it will be somewhat difficult to open up the market recently. As the proportion of the high quality and high attach products is improved in Chinese economics and the pipeline webs are steadily bettered, the number of industrial consumers will rise in about 2020.

Along with the enhancing of the pressure of the city environment, the prospect of the developing of the natural gas cars is regarded as good. The number of the natural cars will be highly increased when the cover of the natural gas pipeline webs is extended step by step and natural gas is basically disseminated.

As predicted, the requirement of natural gas by other users such as industry will be 18.2 billion m^3 in 2010 and 39.1 billion m^3 respectively.

4.2 Supplying Ability

In China, the natural gas resource is plentiful. The total volume of all country amounts to 38 thousand billion m^3. It is estimated that the final reserves which can be verified may exceed 10 thousand billion m^3. In recent years, the verified reserves of the natural gas increase rapidly, with a progressively increasing rate of 10% per year after the "Eighth five-year plan". There is a very high potential of production-increasing in the natural gas.

However, the religion layout of the natural gas resource is in a state of extreme imbalance. The reserves of natural gas in the eastern part are only 10% of that in Chinese mainland. Most of natural gas is buried in western and central China. This causes many difficulties in natural gas production in China. They are: producing areas are far from consuming areas; natural gas pipelines are seriously scarce; transporting fee of natural gas increases; it is difficult to open up the natural gas market, etc.

It is predicted that the yield of the natural gas in China will reach 70 billion m^3 in 2010. It may reach the yield of 75 billion m^3 if the pipeline webs of natural gas can keep pace with . By 2020 in China, the amount will come to 100 billion m^3, perhaps a peak of 150 billion m^3 if there are great developments of pipeline webs' construction and market demand.

Table 4—5 Estimation of Natural Gas Supplying

	1996(Practical)	2010	2020
Domestic yield	201.1	700—750	1000—1500
Insufficiency	——	150—200	500—1000

4.3 Characters of the Chinese Natural Gas Market and Corresponding Countermove

(1) The natural gas resource is plentiful, but the verified degree is very low. Sticking to developing both oil and gas, increasing investments and promoting natural gas explorations have already been important tasks for furthering the development of natural gas.

(2) The potential of producing natural gas is fairly large while the layout of the producing areas and consuming areas is in a state of extreme imbalance. The technical requirements of transporting natural gas are very high and the pipeline webs of natural gas are not constructed. Therefore, there are great restrictions on both natural gas producing and consuming. It will be another presupposition whether the pipeline webs of natural gas can be constructed as soon as possible, which decides whether the market can be developed rapidly or not.

(3) In China, gas fields are more, but big ones are not. Small or medium gas fields with a reserve of less than 10 billion m^3 account for 80% of the 100 or more oil and gas fields already found. The natural gas yield of most of the oil and gas producing enterprises is under 1 billion m^3, even the highest of Sichuan gas field is only 7.5 billion m^3. It doesn't have the ability to transport outside in a large scale. Consequently, in China, natural gas is mainly consumed by local areas, thus being unable to bring along the forming of the large-sized natural gas pipeline webs efficiently.

(4) In China, the natural gas consumers' ability of upholding the price is very inferior. The natural gas market is sensitive to the gas price. So, the government should give a greater support in policy and with capitals to natural gas producing and consuming, especially to construction of infrastructure such as pipeline webs, to cut down the price of natural gas and to boom the natural gas market rapidly.

4.4 Probability of import

There exists a difference between the demand for natural gas in China and the domestic yield. The difference will be of almost 20 billion m^3 in about 2010 and perhaps 50--100 billion m^3 till 2020. Imported natural gas will be an important composition of Chinese natural gas supplying.

According to the update condition of worldwide natural gas market, the gas supplying is quite sufficient The residual exploitable reserves of natural gas in area of West Sebrian, Russia, are right 38 thousand billion m^3. It can support to China more than 20 billion m^3 natural gas a year. The reserves in area of East Sebrian are 44 thousand billion m^3. It can output outside about 20 billion m^3 a year. Turkmenstan, in West Asia, has a natural gas reserves of about 14 thousand billion m^3. Its residual verified gas in place is 3 thousand billion m^3 or so. It has a considerable great willing to export.

Religions such as Mideast, South-east Asia and Australia, etc. also have great exporting potentials. The LNG factories being constructed at present in those areas are able to add to a LNG productivity of more than 20 million tons. The newly increased productivity, mainly faced to the Asia market, will be more than 50 million tons if there is demand dragging. Qatar, Oman, Indonesia, Malaya and Australia all can support large amounts of LNG to China. Because natural gas importing through LNG has such flexible and economical etc. characters, it will be taken seriously at the starting stage of development of Chinese natural gas market.